Interrupts

Data transfer between the CPU and the peripherals is initiated by the CPU. But the CPU cannot start the transfer unless the peripheral is ready to communicate with the CPU. When a device is ready to communicate with the CPU, it generates an interrupt signal. A number of input-output devices are attached to the computer and each device is able to generate an interrupt request.

The main job of the interrupt system is to identify the source of the interrupt. There is also a possibility that several devices will request simultaneously for CPU communication. Then, the interrupt system has to decide which device is to be serviced first.

Priority Interrupt

A priority interrupt is a system which decides the priority at which various devices, which generates the interrupt signal at the same time, will be serviced by the CPU. The system has authority to decide which conditions are allowed to interrupt the CPU, while some other interrupt is being serviced. Generally, devices with high speed transfer such as *magnetic disks* are given high priority and slow devices such as *keyboards* are given low priority.

When two or more devices interrupt the computer simultaneously, the computer services the device with the higher priority first.

Types of Interrupts:

Following are some different types of interrupts:

Hardware Interrupts

When the signal for the processor is from an external device or hardware then this interrupts is known as **hardware interrupt**.

Let us consider an example: when we press any key on our keyboard to do some action, then this pressing of the key will generate an interrupt signal for the processor to perform certain action. Such an interrupt can be of two types:

- **Maskable Interrupt**

  The hardware interrupts which can be delayed when a much high priority interrupt has occurred at the same time.

- **Non Maskable Interrupt**

  The hardware interrupts which cannot be delayed and should be processed by the processor immediately.

Software Interrupts

The interrupt that is caused by any internal system of the computer system is known as a **software interrupt**. It can also be of two types:

- **Normal Interrupt**

  The interrupts that are caused by software instructions are called **normal software interrupts**.

- **Exception**

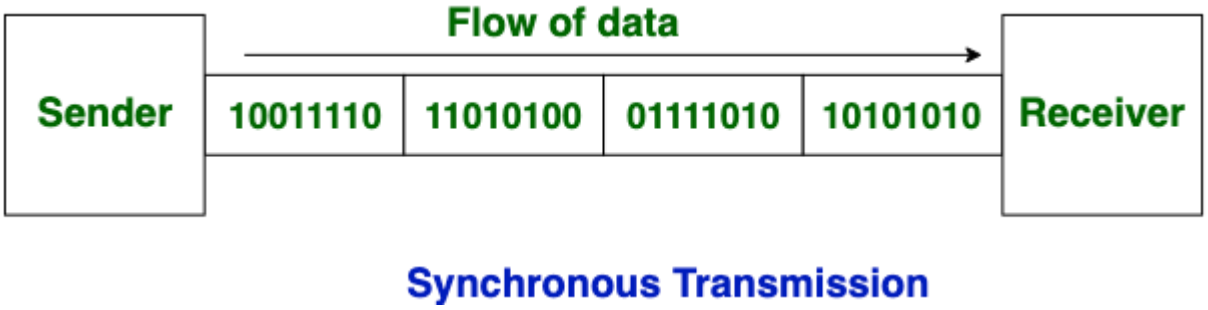
  Unplanned interrupts which are produced during the execution of some program are called **exceptions**, such as division by zero.

Handling Multiple Devices:
When more than one device raises an interrupt request signal, then additional information is needed to decide which which device to be considered first. The following methods are used to decide which device to select: Polling, Vectored Interrupts, and Interrupt Nesting. These are explained as following below.

1. **Polling:**
   In polling, the first device encountered with with IRQ bit set is the device that is to be serviced first. Appropriate ISR is called to service the same. It is easy to implement but a lot of time is wasted by interrogating the IRQ bit of all devices.
2. **Vectored Interrupts:**
   In vectored interrupts, a device requesting an interrupt identifies itself directly by sending a special code to the processor over the bus. This enables the processor to identify the device that generated the interrupt. The special code can be the starting address of the ISR or where the ISR is located in memory, and is called the interrupt vector.
3. **Interrupt Nesting:**
   In this method, I/O device is organized in a priority structure. Therefore, interrupt request from a higher priority device is recognized where as request from a lower priority device is not. To implement this each process/device (even the processor). Processor accepts interrupts only from devices/processes having priority more than it.

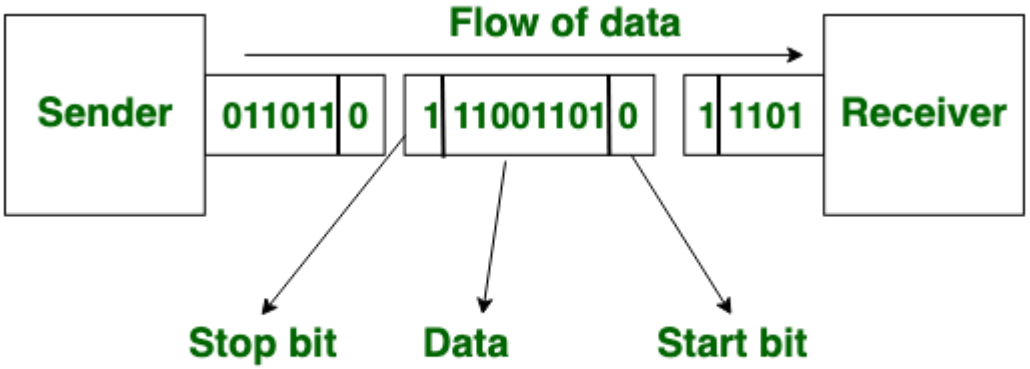
Difference between Synchronous and Asynchronous Transmission

Synchronous Transmission:
In Synchronous Transmission, data is sent in form of blocks or frames. This transmission is the full duplex type. Between sender and receiver the synchronization is compulsory. In Synchronous transmission, There is no gap present between data. It is more efficient and more reliable than asynchronous transmission to transfer the large amount of data.



Synchronous Transmission

Asynchronous Transmission:
In Asynchronous Transmission, data is sent in form of byte or character. This transmission is the half duplex type transmission. In this transmission start bits and stop bits are added with data. It does not require synchronization.



Asynchronous Transmission

Now, let's see the difference between Synchronous and Asynchronous Transmission:

S.NO	SYNCHRONOUS TRANSMISSION	ASYNCHRONOUS TRANSMISSION

1.	In Synchronous transmission, Data is sent in form of blocks or frames.	In asynchronous transmission, Data is sent in form of byte or character.
2.	Synchronous transmission is fast.	Asynchronous transmission is slow.
3.	Synchronous transmission is costly.	Asynchronous transmission economical.
4.	In Synchronous transmission, time interval of transmission is constant.	In asynchronous transmission, time interval of transmission is not constant, it is random.
5.	In Synchronous transmission, There is no gap present between data.	In asynchronous transmission, There is present gap between data.
6.	Efficient use of transmission line is done in synchronous transmission.	While in asynchronous transmission, transmission line remains empty during gap in character transmission.

7.	Synchronous transmission needs precisely synchronized clocks for the information of new bytes.	Asynchronous transmission have no need of synchronized clocks as parity bit is used in this transmission for information of new bytes.